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Device for producing filter cigarettes

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## Description

The invention relates to a device for producing filter cigarettes, in which an outer filter cover - cork paper - has openings which are introduced into the filter cover by a perforation element, the openings being checked by introducing a flowing medium - test air - at one end of the filter and measuring the air - exit air - emerging via the openings.

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The openings made in the filter of a filter cigarette or in the cork paper of the filter are used to supply external air during the enjoyment of the cigarette. The volume of external air supplied in this way must be maintained exactly. For this purpose, it is necessary for the openings in the cork paper to be matched in terms of number and size. The openings are made in the cork paper by a perforation element, in particular by a laser perforation element.

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In order to ensure the quality of the cigarettes, it is usual to test these (in the manner of random samples) with the aid of air. The latter is usually introduced via a (filter) end of the cigarette. The air emerging via the openings of the filter and/or of the cigarette paper or at the opposite end of the cigarette is measured and compared with comparative values. Faulty cigarettes can be identified and separated out in this way.

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The invention is based on the object of improving the production of, in particular, filter cigarettes with regard to quality and of transmitting any deficiencies in quality automatically to the production process.

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In order to achieve this object, the device according to the invention for producing filter cigarettes is characterized by the following features:

- 5 a) the perforation element is arranged in the region of the device for producing the filter cigarettes,
- b) the perforation element can be adjusted with regard to the number and/or size of the openings  
10 to be made in the filter cover,
- c) the measurement of the exit air in the region of the openings of the filter cover can be supplied to a computer,  
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- d) the perforation element is connected to the computer and the latter, the number of openings to be made and/or the size of the same can be adjusted in accordance with the measured results.  
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The filter cigarettes are tested in the production device following the making of the openings, in particular also with regard to the correct formation of the openings. The results are converted into signals,  
25 via pressure measuring elements or measuring probes, and are supplied to a computer. The perforation element, in particular the laser perforation element, is connected to the latter in such a way that an adjustment to the perforation unit with regard to the  
30 size and/or number of the openings to be produced in each filter is carried out in accordance with the measurements. Accordingly, a closed control loop is formed, which is based on continuous or cyclic testing of the cigarettes produced.

35 The perforation element, in particular laser perforation element, can according to the invention act in the region of the finished filter cigarettes, but alternatively, in the region of the device, can be

assigned to a station for fitting the cork paper and positioned above a track for the cork paper, so that the cork paper is perforated immediately before being applied to the cigarettes and also immediately before  
5 being separated from cork paper blanks.

Furthermore, the invention relates to a special configuration of the testing device by forming delimited testing chambers in the region of a testing  
10 turret.

Further details and features of the invention will be explained in more detail in the following text by using exemplary embodiments of the invention. In the  
15 drawing:

- fig. 1 shows an extract from a cigarette production machine with a schematic illustration of conveying and finishing elements in side view,  
20 fig. 2 shows a detail of the device according to fig. 1, namely a testing conveyor in side view,  
fig. 3 shows a cross section through the detail according to fig. 2 in the section plane III-III on an enlarged scale,  
25 fig. 4 shows a cross section through the detail according to fig. 3 in the section plane IV-IV,  
fig. 5 shows a cross section through the detail according to fig. 3 in the section plane V-V,  
fig. 6 shows a schematic illustration of the testing  
30 of cigarettes and the evaluation of test signals,  
fig. 7 shows another exemplary embodiment of a testing drum in schematic side view,  
fig. 8 shows a cross section through a subregion of  
35 the testing drum in a section plane VIII-VIII from fig. 7 on an enlarged scale.

What is concerned here is the production and testing of filter cigarettes 10. These comprise a tobacco stick 11 and a filter 12 attached to the latter on one side.

5 Tobacco stick 11 and filter 12 are joined to each other by an (outer) cork paper. The latter has a circumferential row of openings 13 for the supply of external air into the filter 12 during smoking (ventilation holes).

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The filter cigarettes 10 are produced by a cigarette production machine (maker). Of the latter, a partial unit is shown in simplified form in fig. 1, namely a tipper. The latter substantially comprises a main drum 14 having hollows to accommodate cigarettes and filters on the circumference. In the region of the main drum 14, (double-length) tobacco sticks are severed, joined to a (double-length) filter plug and are then severed centrally, so that finished filter cigarettes 10 leave 15 the main drum 14 via a take-off drum 15. The latter transports the filter cigarettes 10 lying beside one another in pairs in the axial direction - in hollows - to an intermediate drum 16.

25 In this region, the filter cigarettes 10 are provided with the openings 13. For this purpose, a perforation element, in particular laser perforation element 17, is positioned above the intermediate drum 16 and simultaneously provides the (two) filters 12, 30 respectively facing each other, of the two filter cigarettes 10 lying in a common hollow, with the openings 13. The filter cigarettes 10 are rotated in the process.

35 The filter cigarettes 10 completed to this extent are transferred by the intermediate drum 16 to a testing conveyor, namely to a testing drum 18. The latter has hollows 19 arranged along the circumference, in each case to hold a (single) filter cigarette 10.

Interaction of intermediate drum 16, testing drum 18 and a cigarette turner 20 of known design ensures that the filter cigarettes 10 are separated, each second filter cigarette 10 is turned and in this way transferred to the testing drum 18.

In the region of the testing drum 18, the cigarettes are checked for correct formation with the aid of a testing medium, namely in particular with the aid of (compressed) air. The filter cigarettes 10 are transported for example along a lower circumferential half of the testing drum 18. In this lower region, a testing section or a testing station is formed which, in the conveying direction, is offset with respect to an (imaginary) vertical mid-plane of the testing drum 18.

In the region of the testing section, sealing elements, as part of a sealing conveyor 21, are brought up externally to the free side of the filter cigarettes 10. The testing drum 18 is configured specially in the region of the hollows 19 in such a way that, in interaction with the sealing conveyor 21 likewise formed in a special way, testing sections that are delimited from one another and sealed off from one another are produced in the longitudinal direction of the filter cigarettes 10. Testing drum 18 and hollows 19, on the one hand, and sealing conveyor 21, on the other hand, are constructed in such a way that testing chambers 22, 23 are formed along the filter cigarette 10 and permit the independent testing of selected sections of the filter cigarette 10.

The testing drum 18 and its hollows 19 are formed in such a way that a part of the testing chamber 22, 23 is produced by a (cylindrical) widening or deepening of the hollows 19, namely approximately a (cross-sectional) half. The deepenings of the hollows 19 or the testing chambers 22, 23 formed in this way are

delimited from one another, specifically by radially oriented webs 24. Further sealing and connecting elements interact with testing drum 18 and sealing conveyor 21. These are caps 25, 26 of resilient material, in particular rubber. The latter act on both sides of the testing cylinder 18 and are connected to the latter or can in each case be moved by an independent conveyor. The caps 25, 26 are moved up to the two ends of the filter cigarette 10, at least in the region of the testing section, and are placed on said ends, as shown in fig. 3. The caps 25, 26 are provided with a duct or a hole 27 for the supply of compressed air or for the discharge of exit air. Feed lines 48 and discharge lines 47 for compressed air and exit air, respectively, are connected to the caps 25, 26. The testing drum 18 is provided at the ends of the hollows 19 with a semicircular collar 28, 29 which points radially inward and to which the caps 25, 26 are connected in a sealing manner during the testing.

The caps 25, 26 fulfill a further task. During the transfer of the cigarettes or filter cigarettes to the testing drum 18 - in the lower region of the testing drum 18 - the caps 25, 26 are moved up to the ends of the filter cigarettes 10 by means of axial displacement and are placed on the latter. In the region of the testing drum 18, the caps 25, 26 in this way perform the function of supporting and centering the filter cigarettes 10 in the hollows 19.

The sealing conveyor 21 is formed as an outer extension of the hollows 19 of the testing drum 18. The sealing conveyor 21 runs over three deflection rollers 30, 31, 32. Two deflection rollers 31, 32 are positioned adjacent to the circumference of the testing drum 18, so that the sealing conveyor 21 comprising resilient material is pressed onto the testing drum 18 along a circumferential section of the latter, namely with a testing run 33. Alternatively, the sealing conveyor 21

- can also be fitted in the upper region of the testing drum 18 or as a sealing band which runs in a straight line and which is brought up tangentially to the circumference of the testing drum 18. A further  
5 alternative is the formation of the sealing conveyor as a sealing drum. Finally, individual, radially displaceable plungers can also interact with the testing drum 18 as sealing elements.
- 10 The sealing conveyor 21 is formed with matching hollows 34. These correspond to the hollows 19 of the testing drum 18 with regard to the definition of the testing chambers 22, 23.
- 15 Accordingly, an outer collar 35, 36 of the sealing conveyor 21 is placed on the sealing caps 25, 26 in a sealing manner in the region of the testing section, specifically in the region of the testing run 33. Opposite the web 24, a matching web 37 is formed which,  
20 together with the web 24, forms a circumferential sealing ring and in this way delimits the testing chamber 22 from the testing chamber 23. The matching hollows 34 are formed in a manner corresponding to the hollows 19, that is to say with depressions or  
25 widenings with respect to the filter cigarette 10, so that the testing chambers 22, 23 surround the filter cigarette 10 all around and have a circular cross section.
- 30 The sealing conveyor 21 is constructed in a special way; specifically it comprises a pulling run 38 which can be loaded and a resilient sealing layer 39 applied to the latter.
- 35 In the exemplary embodiment shown, two regions of the filter cigarette 10 are tested independently, namely the tobacco stick 11, on the one hand, and the filter 12, on the other hand. The sealing elements, namely web 24 and matching web 37, are positioned in the

region of a dividing plane between the tobacco stick 11 and filter 12. Testing air or compressed air is introduced into the filter cigarette 10 on the filter side via the cap 25. Testing air emerges via the openings 13 from the filter 12 into the testing chamber 22. An exit hole 40 for the exit air to be tested is connected to said testing chamber 22. The exit hole 40 is formed as a curved duct in the region of the testing drum 18, can alternatively also be fitted in the region of the sealing conveyor 21. The exit hole 40 is connected to a measuring device, in particular a measuring probe, for testing the exit air.

The testing air introduced into the filter cigarette 10 passes into the region of the tobacco stick 11. Any losses occurring in this region are tested by means of the exit air picked up at the free end of the tobacco stick 11, that is to say the testing air emerging through the hole 27 in the cap 26. As shown in fig. 3 and fig. 5 (continuous lines in fig. 3), the sealing conveyor 21 extends only in the region of the filter 12. The tobacco stick 11 is exposed on the radially outer side.

As indicated by dashed lines in fig. 3, the sealing conveyor 21 can alternatively extend over the full width of the testing drum 18 and the filter cigarette 10. In this case, any air possibly emerging laterally in the region of the tobacco stick 11 is discharged via an exit hole 41 and led to a testing probe.

In the exemplary embodiment according to fig. 7 and fig. 8, the separate sealing conveyor 21 is replaced by sealing elements which are connected to the testing drum 18, which are assigned to each hollow 19 and are moved during the revolution of the testing drum 18, namely from a withdrawn initial position into a sealing position forming the testing chambers 22, 23. Flap-like sealing pieces 42 are mounted on the testing drum



18 such that they can be pivoted. Each sealing piece 42 can be moved from an initial position oriented axially transversely (dashed lines in fig. 8) into a sealing position with contact with the testing drum 18 and the filter cigarette 10. In the withdrawn position, the sealing piece 42 is positioned such that the filter cigarette 10 can be brought up freely and unimpededly approximately in the radial direction to the circumference of the testing drum 18 and can be laid in the hollows 19. Likewise, the tested cigarettes are taken off the testing drum again approximately in the same region (fig. 7, right).

The sealing pieces 42 are formed in such a way that testing chambers 22, 23 are formed in interaction with the testing drum 18. In the exemplary embodiment shown, a sealing piece 42 is provided which creates a testing chamber 22 only in the region of the filter 12. For this purpose, the sealing piece 42 forms at the free edge a sealing lip 43, which is opposite the web 24 of the testing drum 18 and encloses the filter cigarette 10 and the filter 12 in a semicircle so that, supplementing the web 24, a circumferential, closed seal of the filter-side testing chamber 22 is created. Accordingly, the sealing piece 42 is formed in such a way that, on the side facing the filter cigarette 10, in each case a hollow semicircular cross section is formed, which forms an extension of the corresponding hollow space of the hollows 19. A testing chamber 22 of circular cross section is likewise formed in this way. The movement of the testing pieces 42 is carried out in a manner similar to the rotation of the testing turret 18, in particular by means of (stationary) cam tracks which, via guide rollers, move the sealing piece 42 out of the initial position (axially transverse) into the sealing position (axially parallel) and back. The individual sealing pieces 42 can be pivoted about a pivoting bearing or hinged joint 53 for this purpose, specifically from an axially transversely oriented

initial position into the sealing position resting on the filter cigarette 10 and web 24.

The construction of a special testing system for a filter cigarette 10 is shown schematically in fig. 6.

5 The testing drum 18 is assigned a computer 44; test signals are supplied to the latter. In the example shown in fig. 6, a plurality of testing chambers 22, 23 are formed, namely two testing chambers 22 in the region of the filter 12 and a further testing chamber 10 23 in the region of the tobacco stick 11. Each testing region or each testing chamber 22, 23 is connected via a line for the exit air, namely an exit line 45, to an associated pressure meter 46 or a pressure probe.

15 In the drawing, dashed lines show elements which can be used optionally, namely the subdivision of the testing region of the filter cigarettes 10 into two testing chambers and the formation of a further testing chamber 23 in the region of the tobacco stick 11.

20 At the free end of the tobacco stick 11, that is to say at the burning end, as it is known, there follows an exit line 47, specifically to the cap 26. This likewise leads to a pressure meter 46 (pressure probe).

25 All the pressure meters 46 are connected to the computer 44 via signal lines, so that the data from the pressure meters 46 can be supplied to the common computer 44 and processed here. A test gas, in particular compressed air, is supplied to the filter 30 cigarette 10, namely to the free end of the filter 12, via a feed line 48. Arranged in the feed line 48 is a control valve 49, in order to regulate the pressure of the test air as a function of stipulations from the 35 computer 44. The procedure is expediently such that, immediately after the fitting of the caps 25, 26 to the ends of the filter cigarette, test air is introduced into the cigarette via the feed line 48, in order that any air pressure fluctuations at the testing point -

corresponding approximately to the section plane III-III in fig. 2 - have abated. The actual test air is accordingly supplied only briefly, cyclically, and in a manner regulated exactly by the control valve. After  
5 that, the supply of air is switched off.

Before the compressed air enters the region of the filter cigarettes 10, a branch line is connected to the feed line 48. This branch line 50 leads to a further  
10 pressure meter 46, which is likewise connected to the computer 44.

In the computer 44, the measured data and variables are compared with reference values. These can be provided  
15 automatically to the computer 44 by a machine control system 51 via a line 52.

The computer 44 in turn passes the data determined, namely in particular deviations from reference values,  
20 on to the machine control system 51 or alternatively directly to units that operate independently, for example to the laser 12. On the basis of the control signals determined, the necessary changes in the region of the production of the tobacco sticks 11 and/or of  
25 the filters 12 are introduced, specifically during production.

Data relating to the properties of the cigarettes or folder cigarettes 10 determined by the computer 44 can  
30 be evaluated to see whether tendencies to faults are detected, and changes to the production and other units are then carried out. Setting up a continuous control loop is also possible, to the effect that the measured values lead, continuously or from time to time, to an  
35 adaptation to the production parameters. These in turn effect a change in the measured properties of the filter cigarettes 10, with the effect of a change in the measured data. Accordingly, a closed control loop is created which, by means of continuous or cyclic

testing of the cigarettes, in particular of the air  
(exit air) emerging in the region of the openings 13,  
leads to an adjustment of the perforation element, in  
particular the laser perforation element 17, which may  
5 be required.

The perforation of the cork paper, that is to say the  
making of the openings 13, can be carried out in the  
region of the device on a continuous material web 54 of  
10 the cork paper, a laser perforation element 17 being  
arranged above a conveying section, in particular a  
horizontal conveying section, of the material web 54  
(fig. 1, dashed lines). In this alternative, too, the  
perforation element, in particular the laser  
15 perforation element 17, is connected to the computer 44  
and can be adjusted with regard to the number and/or  
size of openings to be produced. The material web 54  
leads to a unit for producing the cork paper by means  
of dividing it off from the material web 54 and for  
20 feeding it to the cigarettes or to a double cigarette.  
This roll unit 55 is of known design.

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List of designations

10	Filter cigarette	43	Sealing lip
11	Tobacco stick	44	Computer
12	Filter	45	Exit line
13	Opening	46	Pressure meter
14	Main drum	47	Exit line
15	Take-off drum	48	Feed line
16	Intermediate drum	49	Control valve
17	Laser perforation element	50	Branch line
18	Testing drum	51	Machine control system
19	Hollow	52	Line
20	Cigarette turner	53	Hinged joint
21	Sealing conveyor	54	Material web
22	Testing chamber	55	Roll unit
23	Testing chamber		
24	Web		
25	Cap		
26	Cap		
27	Hole		
28	Collar		
29	Collar		
30	Deflection roller		
31	Deflection roller		
32	Deflection roller		
33	Testing run		
34	Matching hollow		
35	Outer collar		
36	Outer collar		
37	Matching web		
38	Pulling run		
39	Sealing position		
40	Exit hole		
41	Exit hole		
42	Sealing piece		